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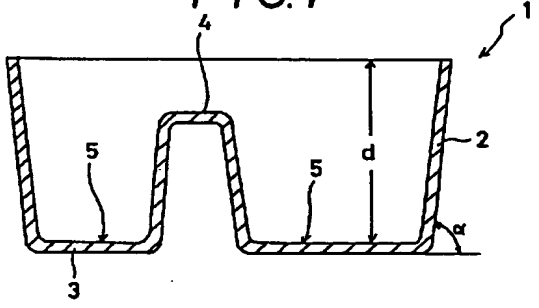
(54) Molded pulp product and production process thereof.

(57) A pulp product molded in a predetermined shape by placing a paper stock on a molding wire to deposit a pulp ingredient in the paper stock on the molding wire, and having a density of at least 0.3 g/cm^3, a rising angle of a side wall of at least 45 degrees and a depth of at least 15 mm is provided. A surface situated on the upper side opposite to the molding wire upon the deposition of the pulp ingredient is finished smoothly. A production process by which such a molded pulp product can be obtained is also provided. The process includes a molding step of depositing a pulp ingredient on a molding wire in a shape conforming to the configuration of the molded pulp product and pressing it from one side, and a hot-pressing step of pressing under heat a molded pulp product intermediate by a pair of female and male pressure molds, which conform to the shape of the molded pulp product.

FIG. 1



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BACKGROUND OF THE INVENTION

1) Field of the Invention:

The present invention relates to a molded pulp product and a production process thereof.

2) Description of the Related Art:

In recent years, products molded from a foamed synthetic resin, pulp products molded by placing a paper stock on a molding wire to deposit a pulp ingredient in the paper stock on the molding wire, and the like have been used as packages for household appliances, precision mechanical equipments and foods. Of these, the molded pulp products made of pulp have been used principally as packaging containers or the like for small-size electrical appliances and foods such as an egg.

In the case where a deep molded product is produced by the molding of a paper stock, there has heretofore been used a method in which a pulp ingredient in a paper stock is simply deposited on a molding wire formed into a predetermined shape conforming to the configuration of the molded product to be produced, and the wet molded product thus obtained is dewatered to provide the molded pulp product in the predetermined shape.

With respect to the conventional molded pulp products made by such a molding method, however, a surface with which the molding wire comes into contact is relatively smooth, but the other surface (on the upper side opposite to the molding wire upon the molding of the paper stock) is irregular or uneven with the deposited pulp ingredient kept intact. Such a molded pulp product has involved drawbacks that when the molded pulp product is produced in such a manner that the uneven surface becomes a side on which a manufactured article is contained, the article is difficult to be stably contained in the molded pulp product, and when the molded pulp product is made in such a manner that the uneven surface becomes an exterior side to the contrary, the outward appearance of the molded pulp product become poor, resulting in reduction of its value as a product. The conventional molded pulp products have also been accompanied by a drawback that they have remarkably low strength compared with plastic moldings.

SUMMARY OF THE INVENTION

The present invention has been made in view of the foregoing drawbacks of the prior art, and has as its object the provision of a deep molded pulp product smooth in both surfaces and excellent in strength. Another object of the present invention is to provide a process for the production of such an excellent molded pulp product.

In an aspect of the present invention, there is thus provided a pulp product molded in a predetermined shape by placing a paper stock on a molding wire to deposit a pulp ingredient in the paper stock on the molding wire, and having a density of at least 0.3 g/cm^3, a rising angle of a side wall of at least 45 degrees and a depth of at least 15 mm, wherein a surface situated on the upper side opposite to the molding wire upon the deposition of the pulp ingredient is finished smoothly.

In another aspect of the present invention, there is also provided a process for the production of a molded pulp product, which comprises a molding step of placing a paper stock on a molding wire in a shape conforming to the configuration of the molded pulp product to deposit a pulp ingredient in the paper stock on the molding wire, and pressing the thus-deposited pulp ingredient from its upper side opposite to the molding wire by a force plug formed into a shape conforming to the configuration of the molded pulp product and composed of an elastomeric material to dewater the molded pulp ingredient, thereby obtaining a molded pulp product intermediate; and a hot-pressing step of pressing under heat the molded pulp product intermediate by a pair of female and male pressure molds, which conform to the shape of the molded pulp product.

Since the molded pulp product according to the present invention has a rising angle of a side wall of at least 45 degrees and a depth of at least 15 mm, and its both surfaces are finished smoothly, a manufactured article can be stably contained therein. The molded pulp product of the present invention is also excellent in external appearance and hence valuable as a product. Further, the molded pulp product has a density as very high as at least 0.3 g/cm^3 compared with the conventional molded pulp containers, and hence is excellent in mechanical strength such as bending strength and stiffness.

According to the production process of the present invention, the above-described molded pulp product having smooth front and back surfaces and a high density can be obtained.

These and other objects and advantages of the present invention will be readily appreciated from the preferred embodiments of this invention, which will be described subsequently in detail with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view illustrating a molded pulp container as an example of the molded pulp product according to the present invention;

FIG. 2 is a vertical sectional view illustrating a step in the production process according to the present invention; and

FIG. 3 is a vertical sectional view illustrating another step in the production process according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS

Now the present invention will hereinafter be described with reference to the accompanying drawings.

Referring now to FIG. 1, a molded pulp container 1 according to an embodiment of the present invention is illustrated. The container 1 is a deep molded pulp container having a rise angle α of a side wall of at least 45 degrees and a depth d of at least 15 mm. The molded pulp container 1 according to the present invention has a density of at least 0.3 g/cm^3, preferably 0.35-0.9 g/cm^3. The density is very high compared with those of the conventional molded pulp containers.

The molded pulp container 1 of the present invention is obtained by placing a paper stock on a molding wire to deposit a pulp ingredient in the paper stock on the molding wire in a predetermined shape. As illustrated in FIG. 1, the molded pulp container 1 has an projection 4 and a recess 5, which have been formed integrally with each other, at its bottom 3. Although the projection 4 may be formed in only one place on the bottom 3 as illustrated in FIG. 1, or in plural places, and no projection may be formed, the container 1 according to the present invention preferably has the projection 4 in at least one place on the bottom 3. In this case, it is desirable that the projection 4 should be formed so as to have a height ranging from 5 mm to a height substantially equal to the depth of the container 1.

The container 1 of the present invention does not only have a smooth surface on the side (for example, on the side of an exterior surface of the container) coming into contact with a molding wire upon the deposition of the pulp ingredient, which will be described subsequently, but also has a smooth surface on the side (on the side of an interior surface of the container) coming into no contact with the molding wire upon the deposition of the pulp ingredient. In the present invention, the fact that the interior surface of the container is smooth means that irregularities caused by the protrusion of the pulp ingredient deposited on the molding wire do not occur on the side of the interior surface. This does not mean eliminating the formation of a minute irregular pattern on the surface.

The molded pulp container 1 of the present invention can be produced in the following manner.

Referring now to FIG. 2, a molding device 6 for producing the molded pulp container 1 of the present invention is illustrated. The molding device 6 includes a molding wire 7 formed into a predetermined shape (in the case of FIG. 2, conforming to the configuration of the exterior surface of the container to be molded), a mold (not illustrated) having an interior surface, which substantially conforms to the configuration of the exterior surface of the molding wire 7, and a plurality of through-halls, through which water can pass, defined in its side wall and bottom, and adapted to support the molding wire 7, a support frame 8 for supporting the mold, and a force plug 9 formed into a predetermined shape (in the case of FIG. 2, substantially conforming to the configuration of the interior surface of the container to be molded) and composed of an elastomeric material.

In the case where the molded pulp container 1 according to the present invention is produced by means of the above-described molding device 6, a pulp ingredient in a paper stock is first deposited on the molding wire 7. As exemplary methods of depositing the pulp ingredient in the paper stock, may be mentioned a method in which the paper stock is placed on the molding wire 7 to deposit the pulp ingredient on the wire 7 and a method in which the whole frame 8 with the molding wire 7 installed thereon is immersed in a vessel containing the paper stock therein, a part or most of water contained in the paper stock is caused to flow out through the wire 7 by sucking under reduced pressure from below the wire 7 as needed, and the frame 8 is then lifted up to deposit the pulp ingredient in the paper stock on the wire 7.

In the present invention, as the paper stock, may be used any paper stocks known per se in the art and those obtained by adding various kinds of additives to such paper stocks. Regenerated pulp making use of recycled paper may be used as the pulp ingredient for the paper stock. If a part or the whole of the pulp ingredient is reclaimed pulp, no problem arises.

As the molding wire 7, may be used any wires through which water contained in the paper stock is caused to pass, but the pulp ingredient is not caused to pass. Water contained in the paper stock is removed through the molding wire 7. As a result, the pulp ingredient is deposited on the molding wire 7. The amount of the pulp ingredient to be deposited on the molding wire 7 can be controlled by the concentration of fibers in the paper stock and the time required for suction under reduced pressure, which may be conducted upon the deposition of the pulp ingredient on the wire 7 as needed.

As described above, any wires may be used as the molding wire 7 so far as they have a mesh size of a degree that water is caused to pass through, but the pulp ingredient is not caused to pass through. If the mesh of the wire 7 is too coarse, th re is a potential problem that a wire mark may be clearly impressed on a surface of the molded pulp product 1 on the wire side, so that the external appearance of the product 1 is impaired. If the mesh of the wire 7 is too fine to the contrary, clogging tends to occur. It is hence preferable to use a molding wire having an opening size of about 15-80 mesh.

After depositing the pulp ingredient in the paper stock on the molding wire 7 in the above-described manner, the deposited pulp ingredient is pressed by the force plug 9 from its upper side, and the pressure on the lower side of the molding wire 7 is reduced, thereby further dewatering the deposited pulp ingredient to obtain a molded pulp container intermediate 10 containing about 30-70% of water.

As the force plug 9, is used that obtained by forming an elastomeric material into a predetermined shape. As such an elastomeric material, may be used, for example, rubber, elastomeric synthetic resins, foamed synthetic resins, etc. The pressing by the force plug 9 is preferably carried out in such a manner that supposing the apparent thickness of the pulp ingredient deposited on the molding wire 7 is 100, its thickness is reduced to about 10-40. If the pressure on the lower side of the molding wire 7 is reduced, it is preferable to reduce the pressure down to about 700-10 mmHg.

The molded pulp container intermediate 10 thus obtained is then shifted to a hot-pressing step. In the hot-pressing step, the molded pulp container intermediate 10 is held between, for example, a female pressure mold 11 having an interior surface conforming to the configuration of the exterior surface of the molded pulp container intermediate 10 and a male pressure mold 12 having an exterior surface conforming to the configuration of the interior surface of the molded pulp container intermediate 10 to press it under heat. The hot-pressing step is preferably conducted under conditions of a heating temperature of 100-250 °C and a pressing time of 5-200 seconds. It is also desirable to conduct the hot-pressing step in several processes. If the hot-pressing step is carried out in several proc sses, it is preferred that the clearance between the male pressure mold 12 and the female pressure mold 11 should become narrower little by little as the latter h t-pressing process is conducted. The hot pressing is preferably carried out in such a manner that supposing the apparent thickness of the pulp ingredient deposited on the molding wire 7 is 100, the thickness of a final product is about 5-30. A plurality of minute through-holes through which water can pass may be defined in these pressure molds. Further, the cavity between the pressure molds may be decompressed by sucking through the through-holes.

As described above, a molded pulp container 1 according to the present invention, of which a surface situated on the upper side upon the deposition of the pulp ingredient has been made smooth and which has a density of at least 0.3 g/cm^3, preferably 0.35-0.9 g/cm^3, can be obtained by first pressing the pulp ingredient deposited on the molding wire 7 from its upper side by the force plug 9 composed of the elastomeric material to dewater the deposited pulp ingredient, thereby obtaining a molded pulp container intermediate 10, and then further hot-pressing the molded pulp container intermediate 10.

The present invention will hereinafter be described in further detail by the following example and comparative example.

Example 1:

A container 1 having the same shape as that shown in FIG. 1 and a depth d of 4.5 cm, a rising angle α of a side wall of 85° (the height of a projection 4: 3.5 cm; the width of the projection 4: 2.5 cm) was produced by means of the same device as that shown in FIG. 2. As the molding wire 7 in the device used, was used that obtained by forming a 40-mesh net. A force plug formed of silicone rubber was used as the force plug 9. Using, as the paper stock, that having a cellulose concentration of 0.5%, the molding wire 7 was immersed for 5 seconds in the paper stock with the wire installed on the frame 8 through the wire-supporting mold. The wire 7 was then lifted up from the paper stock. The apparent thickness of the pulp ingredient deposited at this time was about 4.5 mm. The pulp ingredient deposited on the wire 7 was then pressed from its upper side by the force plug 9, while the pressure on the lower side of the molding wire 7 was reduced to 200 mmHg. The thus-obtained intermediate had a thickness of about 3 mm.

The molded pulp container intermediate 10 thus obtained was held between the same female pressure mold 11 and male pressure mold 12 as those shown in FIG. 3 to hot-press it for 10 seconds. At this time, the temperatures of the female and male pressure molds 11 and 12 were each 170 °C, and the thickness of the pulp container after th pressing was about 2 mm. Subsequently, similar hot pressing was conducted further twice. The thickness of the molded pulp container after such hot pressing was about 1.2 mm after the second h t pressing and ab ut 0.7 after the third

hot pressing. The molded pulp container thus obtained had a density of 0.4 g/cm^3 and excellent smoothness in the interior and exterior surfaces of the container. An iron plate having a weight of 15 kg was then placed slowly on the container so as to cover the whole opening of the container. As a result, the container was able to bear the weight of the container.

Comparative Example 1:

A molded pulp container was obtained in the same manner as in Example 1 except that any hot pressing was not conducted. This container had excellent smoothness in the surface pressed by the silicone rubber plug. However, a wire mark was clearly impressed on the surface situated on the side coming into contact with the molding wire. The container thus obtained had a density of 0.28 g/cm^3. In a similar manner to Example 1, an iron plate having a weight of 15 kg was placed on the container. As a result, the container got out of shape. It was hence confirmed that the strength of this container is poorer than that obtained in Example 1.

Claims

1. A pulp product molded in a predetermined shape by placing a paper stock on a molding wire to deposit a pulp ingredient in the paper stock on the molding wire, and having a density of at least 0.3 g/cm^3, a rising angle of a side wall of at least 45 degrees and a depth of at least 15 mm, wherein a surface situated on the upper side opposite to the molding wire upon the deposition of the pulp ingredient is finished smoothly.

2. The molded pulp product as claimed in claim 1, wherein the density is 0.35-0.9 g/cm^3.

3. The molded pulp product as claimed in claim 1 or 2, which has at least one projection formed integrally upon the deposition of the pulp ingredient and rising from its bottom.

4. The molded pulp product as claimed in claim 3, wherein the projection has a height substantially equal to or lower than the depth of the molded pulp product, but not lower than 5 mm.

5. A process for the production of a molded pulp product, which comprises:

   a molding step of placing a paper stock on a molding wire in a shape conforming to the configuration of the molded pulp product to deposit a pulp ingredient in the paper stock on the molding wire, and pressing the thus-deposited pulp ingredient from its upper side opposite to the molding wire by a force plug formed into a shape conforming to the configuration of the molded pulp product and composed of an elastomeric material to dewater the molded pulp ingredient, thereby obtaining a molded pulp product intermediate; and

   a hot-pressing step of pressing under heat the molded pulp product intermediate by a pair of female and male pressure molds, which conform to the shape of the molded pulp product.

6. The process as claimed in claim 5, wherein a part or the whole of the pulp ingredient contained in the paper stock is regenerated pulp.

7. The process as claimed in claim 5 or 6, wherein in the hot-pressing step, the molded pulp product intermediate is successively hot-pressed by plural pairs of pressure molds, which have been preset in such a manner that the respective clearances between a male pressure mold and a female pressure mold become gradually narrower.

FIG.1

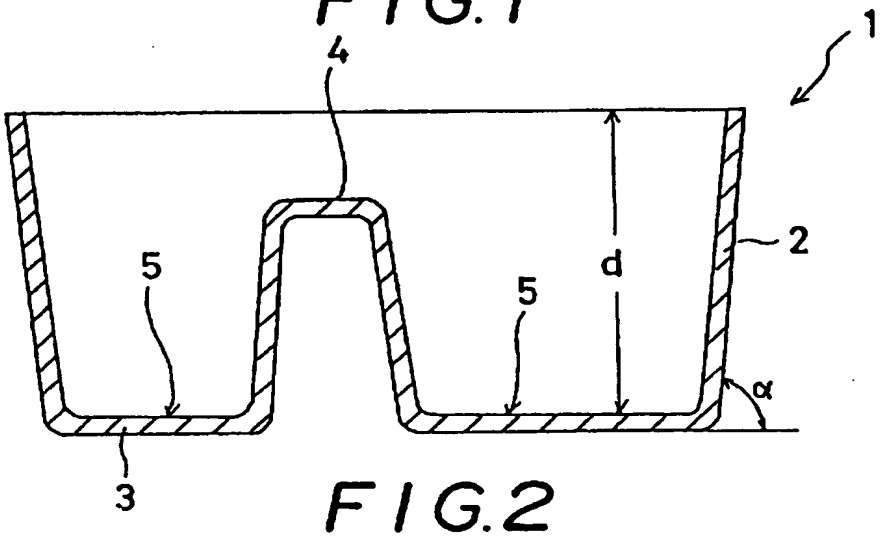


FIG.2

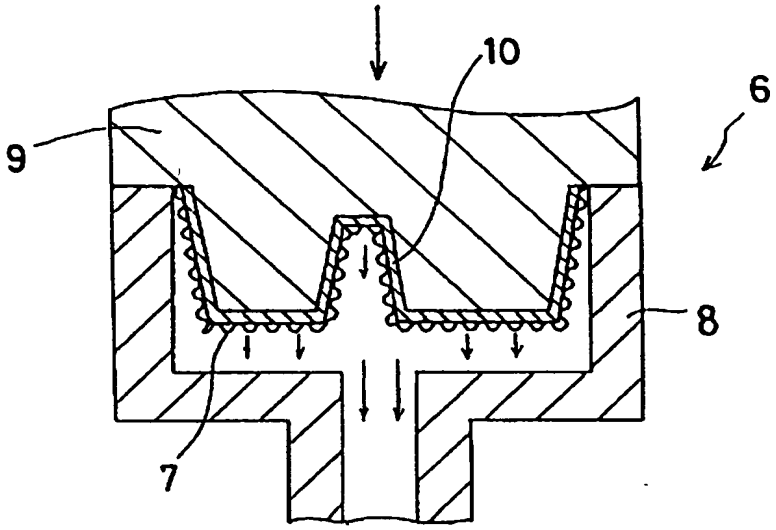
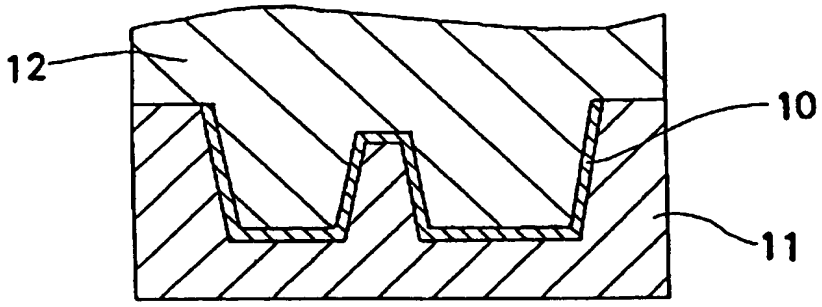


FIG.3



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EUROPEAN SEARCH REPORT

Application Number
EP 93 10 4918

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-1 288 923 (HENRY BOUCHER FILS & CIE) * the whole document *	1	D21J7/00 D21J5/00
A		5	
A	US-A-4 152 203 (LORD) * the whole document *	1,3,5	
A	FR-A-1 260 470 (DIAMOND NATIONAL CORPORATION) * the whole document *	1,3,4,5	
A	NL-A-49 987 (HARTMANN) * the whole document *	5,7	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D21J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 JUNE 1993	DE RIJCK F.

CATEGORY OF CITED DOCUMENTS

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